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ABSTRACT

A study investigated (1) the effectiveness of giving instructions to form mental images prior to reading a text and at the conclusion of the text, and (2) sex differences in the ability of below average readers to form mental images. Subjects were 47 sixth grade students who were below average readers. The subjects were randomly assigned, by sex, to one of two treatment groups. In one group, subjects were given instructions to form imagery prior to reading an expository passage; and in the other group, subjects were told to form imagery at the conclusion of reading the same passage. After reading the passage, subjects in both groups were asked to retell the story and to answer recall questions about it. Findings revealed that instructions to form mental imagery given prior to reading a text increased literal comprehension and that males benefited significantly more than females from instructions to form mental imagery about a text. (FL)

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Mental Imagery and the Reading Comprehension of Below
Average Readers: Situational Variables and Sex Differences

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Abstract

In this study the effects of instructions to induce mental imagery prior to text reading and instructions to induce mental imagery as a rehearsal strategy following text reading were investigated. Subjects were sixth grade below average comprehenders. Results indicated that: 1) instructions to induce mental imagery prior to text reading increase literal text comprehension, and 2) males benefit significantly more than females from instructions to induce mental imagery about expository text.

Mental Imagery and the Reading Comprehension of Below
Average Readers: Situational Variables and Sex Differences

A persistent problem in reading research has been the characterization of how readers understand and remember text information. Recent research has suggested that mental imagery improves comprehension by facilitating the functional capacity of working memory (Lesgold, Curtis, DeGold, Golinkoff, McCormick & Shimron, 1974; Lesgold, McCormick & Golinkoff, 1975; Levin, 1973; Linden & Wittrock, 1981; Pressley, 1976). Steingart and Glock (1979) have more specifically suggested that mental imagery aids the reader in organizing incoming text information, resulting in increased comprehension and memory of information.

It has been argued that instruction should be directed toward the acquisition of broadly generalizable cognitive skills that can be applied in a variety of learning situations (Wicker, Weinstein, Yelich & Brooks, 1978). Recent research has, in general, supported the contention that mental imagery is a cognitive skill used by some learners to enhance reading comprehension (Levin, 1973; Linden & Wittrock, 1981). Since mental imagery appears to be associated with efficient learning and remembering, it may provide a critical link for the reader moving from a novice to sophisticated comprehender. There is limited information available, however, on the effectiveness of imagery instructions with students who are experiencing

difficulty in reading comprehension.

Although mental imagery has been studied quite extensively, the situational determinants of its use as a reading comprehension strategy have not been carefully examined. In the research reported to date, instructions to form mental images have been given prior to text reading (Anderson & Kulhavy, 1972) and intermittently during text reading (Koskinen & Gambrell, 1980; Pressley, 1976) to encourage readers to form images while reading. It has been hypothesized that directions to induce mental imagery while reading results in increased comprehension as a result of the dual coding that occurs with respect to verbal (print) and visual (images) processing of information (Paivio, 1974). It may well be that for the below average comprehender forming mental images while reading may add an additional processing burden which may actually inhibit comprehension.

It seems plausible that following the reading of text material, instructions to form mental images about the information or events in the text would encourage the learner to use mental imagery as a rehearsal strategy. Instructions to induce mental imagery at the conclusion of text reading would not require dual coding to occur simultaneously but might possibly serve as an effective summarizing or rehearsal strategy for below average comprehenders. None of the mental imagery research has directly addressed the effects of the situational placement of instructions to induce mental imagery with respect to reading.

A review of the existing research on mental imagery and reading resulted in sparse information about possible sex differences in the use of mental imagery. In a study by Gambrell, Koskinen and Cole (1981) above average males recalled more than above average females when instructed to form mental images while reading. Since mental imagery is related to the ability to deal with spacial relationships, an area where boys usually outperform girls (Buffrey & Gray, 1972), sex differences in the use of mental imagery as a strategy for reading comprehension, an area where girls usually outperform boys (Johnson, 1973-74), has been identified as a promising area for research (Gambrell, Koskinen & Cole, 1981).

One necessary and obvious situational variable with respect to the facilitative effects of mental imagery is text-type. The mental imagery research to date has, with a few exceptions (Anderson & Kulhavy, 1972; Gambrell, Koskinen & Cole, 1981), been conducted with narrative text while most school learning is related to the use of expository text. It was anticipated that this investigation would improve our understanding of the role of mental imagery in children's processing and memory for expository text since both classroom teachers and reading researchers have observed that students have difficulty reading and remembering expository text (Baker & Stern, 1978; Berkowitz & Taylor, 1981).

In the present study below average comprehenders were given instructions to form mental images about an expository passage of the type found in textbooks. The study was designed to investigate: 1) the effectiveness of instructions to form mental images prior to reading the text (pre-reading instructions) and at the conclusion of the reading of the text (post-reading instructions), and 2) to determine possible sex differences in the ability of sixth grade below average readers to form mental images.

Method

Subjects

Forty-seven sixth grade below average readers enrolled in five Maryland public schools served as subjects in the study. Criteria for inclusion in the study were: 1) reading comprehension scores obtained from the Iowa Test of Basic Skills between 3.5 and 5.5 grade levels, 2) Cognitive Abilities Test scores within 1 standard deviation above or below the mean, and 3) teacher verification of subject identification as a below average reader.

Materials

The stimulus materials used in this study consisted of a short expository passage written at the 4.0 grade level as

determined by the Fry (1977) readability formula. A set of 10 short answer cued recall questions was constructed. Five of these questions were literal and five were paraphrase.

Procedure

Fifty-one subjects who met the criteria established for inclusion in the study were randomly assigned, by sex, to one of two treatment conditions. Due to absences from school 47 subjects actually participated in the study. In one treatment condition instructions to induce imagery were given prior to reading the expository text, and in the second treatment condition instructions to induce imagery were given at the conclusion of reading the expository text.

Pre-reading mental imagery instructions group. The subjects were met individually for approximately 25-30 minutes. In the pre-reading mental imagery group the subjects were told, "I have a story for you to read. I want you to read it carefully because I am going to be asking you to tell me about the story after you read it. A good way to remember things is to make pictures in your head while you are reading. As you read this story, take your time and try very hard to make pictures in your head to help you remember." The subjects then read the passage silently.

Following silent reading each student filled out an information form requiring name, sex, school, grade and age as an intervening activity to eliminate the effects of short-term memory. Each subject was then asked to retell the story.

Specifically, the subjects were asked to "pretend you are going to tell a friend about what you read. Try to tell everything you can remember about the passage." Each subject was then asked to respond to 10 cued recall questions (5 literal and 5 paraphrase). Responses were recorded by the examiner. Subjects then responded to questions on a follow-up interview about their use of mental imagery. Each subject was told that "some people are able to make pictures in their head about what they read and some people are not able to make pictures in their head." Subjects were then asked whether they were able to form mental images about the specific passage they read during the experiment. Subjects who responded that they were able to form mental images were then asked to rate the vividness of their images on a 5 point likert scale (5 = very clear, 1 = unclear).

Post-reading mental imagery instruction. The subjects in the post-reading mental imagery group were told, "I have a story for you to read. I want you to read it carefully because I am going to be asking you to tell me about the story after you read it." Upon completion of the silent reading subjects were told, "A good way to remember things is to make pictures in your head about what you have read. Take your time and try very hard to make pictures in your head to help you remember." All other procedures were identical for the two treatment conditions.

Results

The independent variables were the two treatment conditions (pre-reading and post-reading mental imagery instructions) and sex. The three dependent variables were scores on the total number of propositions recalled and the responses on the literal and paraphrase cued recall questions. The tapes of the free recall were transcribed for analysis. The number of propositions recalled were tabulated using an adaptation of Meyer's (1975) procedure. The cued recall responses were scored for number of correct answers on the 5 literal and 5 paraphrase questions. Data on the free and cued recall measures were analyzed using analysis of variance procedures. To verify equivalence of comparison groups by treatment and sex a preliminary analysis of the Iowa Test of Basic Skills reading comprehension test scores was conducted. Analysis of variance procedures revealed no statistically significant differences in reading achievement for treatment groups $F(1,43) = 2.037, p > .05$ or for sex $F(1,43) = .0319, p > .05$.

The means and standard deviations for the number of propositions recalled by the pre-imagery and post-imagery groups are shown in Table 1. Results of the analysis revealed no significant main effect for treatment on number of propositions recalled. However, there was a significant main effect for sex $F(1,43) = 5.495, p < .02$. There were no significant interactions involving treatment and sex.

Insert Table 1 about here

The means and standard deviations for literal and paraphrase questions are shown in Table 2. A significant main effect for treatment was found for literal cued recall questions $F(1,43) = 4.152, p < .05$. No significant effect was found for paraphrase cued recall questions. There was a significant main effect for sex on literal questions $F(1,43) = 6.423, p < .02$ and paraphrase questions $F(1,43) = 5.508, p < .02$. Again there were no significant interactions involving treatment and sex.

Insert Table 2 about here

On the following-up interview 83% of the subjects reported that they induced mental imagery about the passage. Only 15% of the males and 14% of the females reported that they were unable to induce mental imagery. Thirty-five percent of the males and 5% of the females reported that their images were "very clear."

Discussion

The findings of this study indicate that mental imagery instructions given prior to text reading facilitate the retention of literal comprehension of expository text. Furthermore, the striking disparity in the performance of males and females suggests that males benefit more from instructions to induce mental imagery than do females.

Other investigations (Gambrell, Koskinen & Cole, 1981; Levin & Pressley, 1981; Pressley, 1976)

have pointed to important situational determinants of the effectiveness of mental imagery instructions such as modality of input (listening versus reading) and text-type (narrative versus expository).

Pressley (1977), in a review of the literature concluded that mental imagery instructions were more facilitative for listening comprehension than for reading comprehension. Gambrell, Koskinen and Cole (1981), however, reported no statistically significant differences on free and cued recall between the effects of induced mental imagery for listening and reading situations for above and below average sixth grade students.

While the effectiveness of mental imagery with expository text has yet to be fully explored, this study is in agreement with the results of previous studies (Steingart & Glock, 1979; Koskinen, Gambrell & Cole, 1981) that support the contention that instructions to induce mental imagery enhances comprehension for expository text. Mental imagery research with young children and below average comprehenders has focused primarily upon narrative prose (Koskinen & Gambrell, 1979; Levin, 1973; Pressley, 1976), therefore, future research is needed to add clarity to the role of mental imagery with expository text.

In addition to the modality and text-type situational determinants of the effectiveness of mental imagery this study has identified the placement of instructions to induce mental imagery as another viable situational determinant.

While the effects of pre-reading mental imagery instructions, as measured by the cued recall test, do not appear to be large, there was a significant difference with respect to literal comprehension in favor of instructions given prior to the reading of expository text. The hypothesis that the dual or simultaneous processing of print and formation of mental images may inhibit reading comprehension for below average comprehenders was not supported. The findings do support the hypothesis that mental imagery instructions given prior to text reading induces dual coding of incoming text which results in increased comprehension (Paivio, 1974; Steingart & Glock, 1979; Linden & Wittrock, 1981).

In an earlier study by Gambrell, Koskinen and Cole (1981) sex differences were found at the sixth grade level with respect to mental imagery and reading comprehension in favor of male above average readers. The male below average comprehenders in the present study recalled significantly more than below average females on the free recall and cued recall questions. The results of the interview conducted at the conclusion of the experimental tasks supports the finding of differential effects for males and females with respect to mental imagery. Thirty-five percent of the males reported very clear mental images while only 5 percent of the females reported very clear images. This finding provides additional evidence that the sixth grade boys in this study were more proficient at inducing mental imagery than the sixth grade girls, which resulted in superior reading comprehension for

boys. The results of this investigation, coupled with the previous findings of Gambrell, Koskinen and Cole (1981), suggest that mental imagery may be a reading comprehension processing strategy that is particularly effective for males.

In conclusion, situational determinants of the use of mental imagery as a reading comprehension processing strategy have yet to be fully explored. Knowledge of the situational factors which increase or decrease the likelihood that mental imagery will be used by the reader can contribute not only to our understanding of the reading process, but also to possible explanations of individual differences in the use of mental imagery. While conclusions drawn from this study must be tentative, the results do indicate that for below average comprehenders: 1) instructions to induce mental imagery while reading are more effective than instructions to induce mental imagery as a rehearsal strategy following text reading, and 2) instructions to induce mental imagery about expository text are more effective for males than for females.

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Table 1
Means and Standard Deviations for Total Propositions
Recalled by Pre and Post Mental Imagery Groups

Pre-Imagery			Post-Imagery		
	$\bar{M}$	SD		$\bar{M}$	SD
Males (N=16)	15.50	5.69	Males (N=10)	16.50	7.75
Females (N=10)	13.00	6.41	Females (N=11)	10.82	2.93

Table 2
Means and Standard Deviations for Cued Recall Tests

		Pre-Imagery Instructions		Post-Imagery Instructions	
		$\bar{M}$	SD	$\bar{M}$	SD
Literal Questions	Males (N=16)	3.75	1.06	Males (N=10)	3.30 1.64
	Females (N=10)	3.10	1.66	Females (N=11)	1.91 1.14
Paraphrase Questions	Males (N=16)	3.63	1.36	Males (N=10)	3.60 1.07
	Females (N=10)	2.70	1.57	Females (N=11)	2.64 1.36